



Evaluation of Model Microphysics Within Precipitation Bands of Extratropical Cyclones

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Introduction

- The representation of clouds in climate and weather models is a driver in forecast uncertainty.
- Cloud microphysics parameterizations are challenged by having to represent a diverse range of ice species.
- Key characteristics of predicted ice species include habit and fall speed, and complex interactions that result from mixed-phased processes like riming.
- Our proposed activity leverages Global Precipitation Measurement (GPM) Mission ground validation studies in Ontario, Canada to improve parameterizations.

Motivating Questions

- How well does the Weather Research and Forecasting (WRF) schemes do in predicting the microphysics for precipitation bands?
- What are the benefits of using more sophisticated double moment ice/snow schemes as well as more advanced riming schemes?

Field Case Study – 18 February 2012

- Figure 1 shows the 12, 4, and 1.33-km WRF domains, and the general study location (red dot).
- On 18 February 2012 there was a weak cyclone near Lake Huron and a weak warm front approaching from the southwest. The WRF was within 1°C and 5 kts and had a proper position

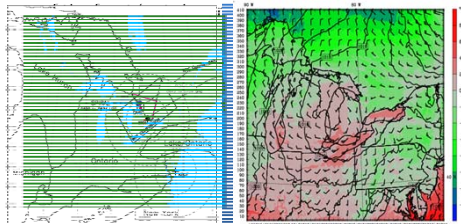


Figure 1. (left) WRF model domains and the GCMEX field location site (red dot). (right) 11-h WRF forecast (at 1100 UTC 18 February 2012) showing SLP (every 2hPa), surface temperature (shaded) and surface winds (full barb = 10 kts).

Observed versus WRF Radar Analysis

- WRF initial and boundary conditions from the 13-km Rapid Refresh at 0000 UTC 18 February. Physics include: YSU? PBL, Kain-Fritsch? CP scheme on 12-km only, and ??? Radiation.
- At 1100 UTC 12 February there was a warm frontal snow band observed near the field study site.
- Most of the WRF models realistically simulated this snowband, except that the Thompson run was too weak.

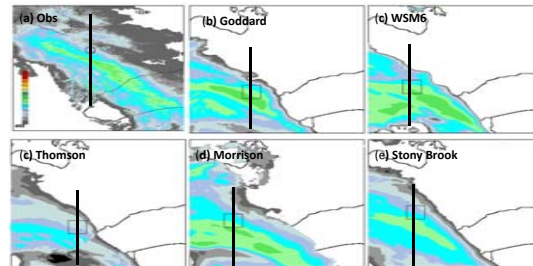


Figure 2. Observed (0.5 deg) vs WRF (surface) reflectivity (shaded) at 1100 UTC 18 Feb 2012. W-E cross section (solid) is band relative.

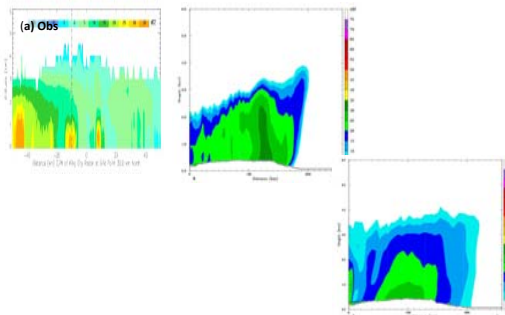


Figure 3 Obs vs WRF cross section plots at 1100 UTC 18 Feb 2012

CROSS SECTION dBZ COMPARISONS

Microphysical Comparisons

- There was a shallow stable layer topped by a mixed layer between 950 and 800 hPa. WRF was 1-2C too cool near the surface and slightly too deep with the mixed layer.

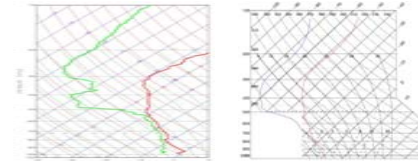


Figure 4. Observed (left) versus WRF (Goddard run) sounding at 0900 UTC.

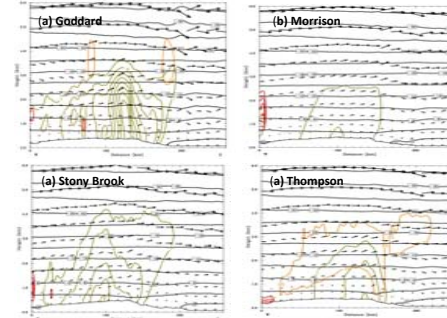


Figure 5. Microphysical cross section comparison at 1100 UTC. Snow is dark yellow, cloud ice is orange, and rain is in red.

Microphysical Cross section comparison text....

Aircraft evaluations

- WRF microphysical predictions were averaged within the boxes in Fig. 2, which is location of aircraft spiral.
- All WRF schemes realistically predicted the ice water content profiles. The Thompson tended to underpredict, and Goddard/SBU-YLIN overpredict.
- Morrison best predicted the snow distribution (slope), but had difficulty with the slope intercept.

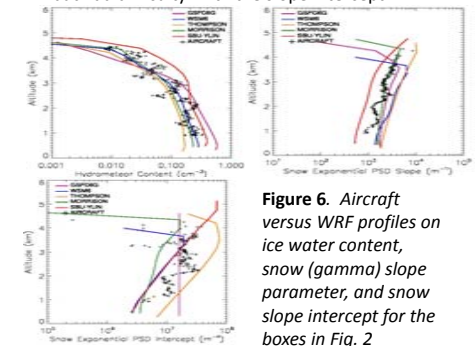


Figure 6. Aircraft versus WRF profiles on ice water content, snow (gamma) slope parameter, and snow slope intercept for the boxes in Fig. 2

Summary and Conclusions

SUMMARY AND CONCLUSIONS TEXT

Acknowledgements

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